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WATER STERILIZATION



JAMES B. CLOW & SONS
CHICAGO







R. U. V.
Radii Ultra ~ Violacei

ULTRA VIOLET RAY WATER STERILIZATION *for*

*Drinking Water, Swimming
Pool and all Commercial
and Domestic purposes.*



*Manufactured under
leased patent rights by*

JAMES B. CLOW & SONS

ESTABLISHED 1878

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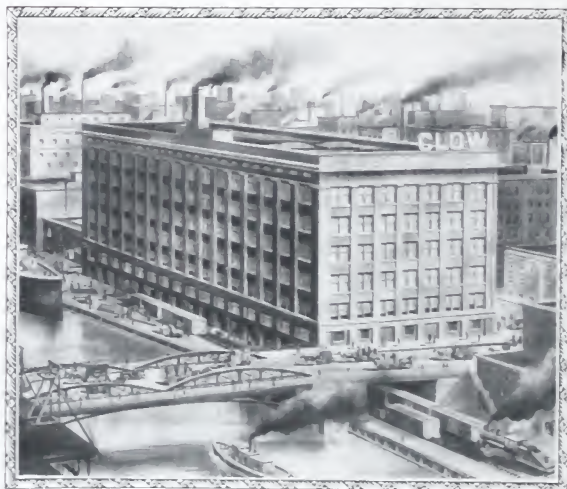
Coshocton, Ohio

Chicago, Ill.

Newcomerstown, Ohio



THE CLOW "BELLDOWN" PLANT, COSHOCTON, OHIO



THE CLOW BUILDING, CHICAGO



THE CLOW "TRIUMPH" PLANT, NEWCOMERSTOWN, OHIO

The STERILIZATION of WATER



N 1892 some peasants washed their soiled clothes in the river Elbe. As a result, 10,000 people in Hamburg died of cholera. Altona, its immediately adjoining sister city, also drew its drinking water supply from the river, but, before delivery to consumers, purified it. No cholera epidemic occurred in Altona though it raged so furiously next door in Hamburg. This startling proof of the efficacy of water purification was actually the beginning of the present widespread conviction of the necessity for it. And that was only twenty-seven years ago.

To-day the United States Government makes water purification on interstate carriers compulsory. It not only defines the standard of purity required, but specifies that the apparatus used must be so constructed that it cannot, under any conceivable circumstance, deliver a water that does not conform to government requirements. It is only twenty-three years ago since the first municipal water purification plant embodying a guaranteed removal of bacteria was constructed. That the Government now finds water purifying apparatus capable of conforming to its exacting requirements is an eloquent tribute to the development of the art.

Less than four years ago the United States Public Health Service began studies and experiments to determine what methods of water purification were capable of meeting government requirements. These are described in detail in Public Health Report, No. 41, Volume 31, issued under date of October 13, 1916. This report states that Ultra Violet Ray Sterilization meets the government requirements in all particulars.

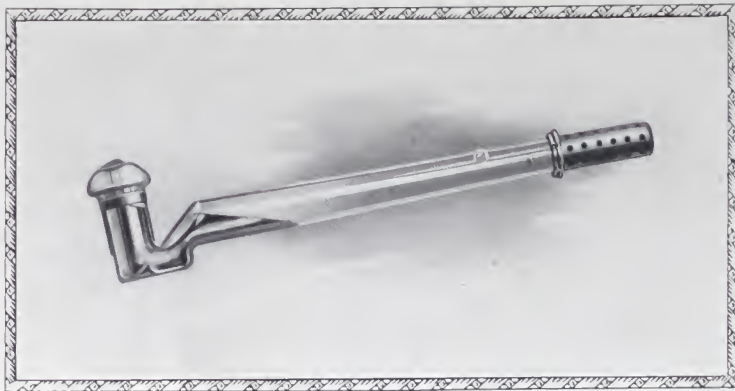
That artificial light would sterilize water was discovered in 1878. It was not until 1910, however, that elaborate experiments, conducted at Sorbonne University, Paris, by Henri, Helbronner and Von Recklinghausen, led to the development of the present apparatus. The first commercial installation of an Ultra Violet Ray Sterilizer in this country was made in 1912 by the Rayvio Water Company, Chicago. It was constructed under license of R. U. V. patents for which a royalty was paid. The following year the R. U. V. Co. Inc. began active business in this country and has been solely responsible for the development of the present remarkable apparatus. Naturally the requirements of the United States Public Health Service were both a spur and an inspiration. To have met them so fully in so short a period of time, however, was a most creditable achievement.

We have acquired from the R. U. V. Co. Inc. the sole right to manufacture and sell Ultra Violet Ray water sterilizing apparatus in the States of Illinois, Indiana, Ohio, Michigan, Wisconsin, Minnesota, and Iowa. We have every facility for the manufacture of this remarkable apparatus. Scrupulous attention to every detail is given. All apparatus, both before and after assembling, is rigidly tested in our own testing laboratory. Proper operation of each apparatus shipped is, therefore, assured.

The process of Ultra Violet Ray sterilization is astonishingly simple. Its results are positive and unavoidable. In the following general description technical details are intentionally omitted. If desired, they will, upon request, be gladly furnished.

What Are Ultra Violet Rays?

All light is vibration. The white light of the sunlight is composed of many colored lights as seen in the rainbow or spectrum. These lights have different wave lengths or intensity of vibration. Of the visible colors, the shortest are those of the violet. Just beyond the violet are the invisible Ultra Violet Rays, which are even shorter and more intense in their vibrations. They are amazingly destructive to germ life. The well-known purifying power of the sunlight is due to these short wave lengths. The exact action responsible for these results is not known.



The Mercury Vapor Lamp

How Are Ultra Violet Rays Produced?

These rays are produced commercially by a mercury vapor lamp,—a mercury vapor arc in a vacuum. The lamp consists of a straight quartz tube, with a bowl at one end, partially filled with mercury. Fused rock crystal, commonly known as quartz is the only solid substance known except ice through which Ultra Violet Rays will pass.

How Is The Mercury Vapor Arc Produced?

Mercury is a conductor. When, therefore, the two ends of the lamp are connected in an electric circuit, electricity flows through the mercury. No Ultra Violet Rays are yet produced. To form the mercury vapor arc, the mercury bridge must be broken. This is done by slightly raising the stem of the lamp, either automatically or by hand. A short mercury vapor arc is now produced, just as the electric spark spans the distance between the carbons in an arc light. The pressure of the mercury vapor gradually forces the mercury up into the bowl until, in a few minutes, no mercury is left in the stem. The mercury vapor arc then extends the whole length of the tube and Ultra Violet Rays of great intensity are produced.

How Are Ultra Violet Rays Adapted To Water Sterilization?

Although these rays will exterminate germ life through a considerable distance, naturally the nearer bacteria are brought to the source of the rays the shorter the period required for extermination. In all types of sterilizers three principles are basic:

1. All the water is continuously exposed to the rays.
2. All the water in its passage through the sterilizer is made to flow near the lamp in a thin film.
3. All the water is continuously stirred or turned over so that all surfaces of bacteria may be exposed to the rays.

What, Then, Is An Ultra Violet Ray Sterilizer?

Briefly, it consists of a mercury vapor lamp set in a water compartment so arranged that water, always exposed to its rays, passes around or near the lamp in a thin film.

Is Ultra Violet Ray Sterilization Applicable To All Waters?

The only condition essential to perfect results is that the water entering the sterilizer be clear and free from suspended matter. Otherwise a bacterium gets behind or inside a particle of suspended matter and escapes exposure to the rays. If, therefore, the water is not clear, it must be filtered before sterilizing. This simple condition being satisfied, perfect results, regardless of the character of the water treated, are assured.

What Effect Upon Water, Other Than Germ Extermination, Has The Process?

Other than germ extermination the process has no effect upon the water treated. It does not change the temperature, taste, appearance, chemical or mineral properties. Water sterilized by Ultra Violet Rays is not "flat."

The following types of Ultra Violet Ray Sterilizers are manufactured by us. They are sold under a guarantee that the water delivered by the sterilizer shall be entirely free from pathogenic or disease producing bacteria.

Type B-2 R. U. V. Sterilizer.

This type operates by gravity and must, therefore, have a free or open discharge at its outlet.

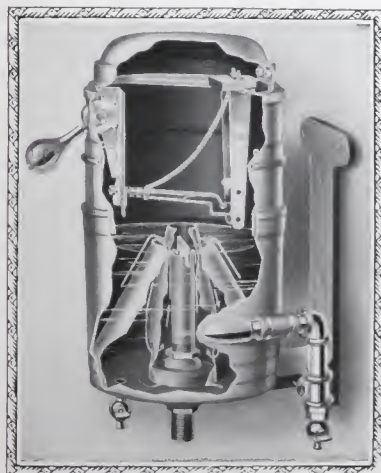
It consists of a brass tank, tinned on the inside to prevent corrosion and painted on the outside with a glazed white celluloid paint. Mounted on this tank is an aluminum hood containing the lamp and lamp starting mechanism. In the top of this hood is a colored glass insert through which the lamp operation may be observed. Surmounting the hood is an aluminum cover. Within the tank are two concentric conical shaped baffles and within these is the outlet pipe. The baffles are built of spun copper tinned to prevent corrosion and are readily removable for cleaning.

The apparatus is 10" in diameter by 18" high and is mounted upon a wall bracket furnished as part of it.

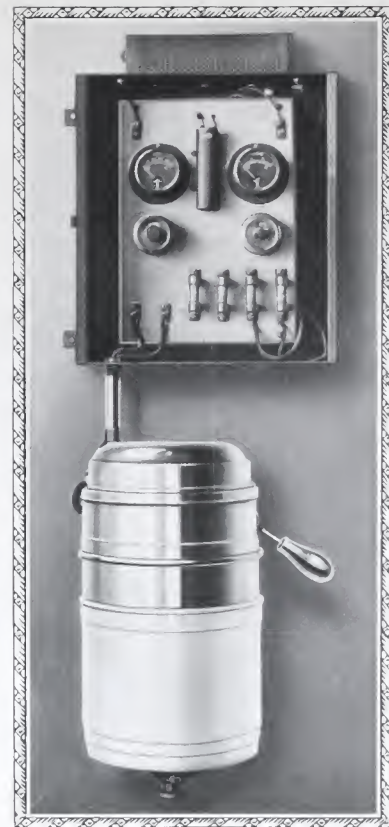
The water enters through the inlet pipe near the bottom. It flows over the outer baffle, down and under the inner baffle, up and over the edge of the outlet pipe and down this pipe to the outlet. These conical shaped baffles prevent shadows from the lamp which is suspended over them just above the water level, and allow continuous exposure of all the water to the rays. They provide two turnings over of the water near the lamp in a thin film.

To start the lamp, turn on the current, lift the starting handle to its full height and immediately lower it. The stem end of the lamp is connected to this mechanism. At some point in this process the mercury in the lamp will necessarily "bridge" and then "break," thus forming the mercury vapor arc as previously described.

The lamp operates on 110 volts direct current at approximately 3.5 amperes. It consumes, therefore, an electrical energy of .385 K. W. Detailed instructions for the operation and adjustment of the lamp for proper current and voltage are furnished with the apparatus.



Type B-2 Sectional View

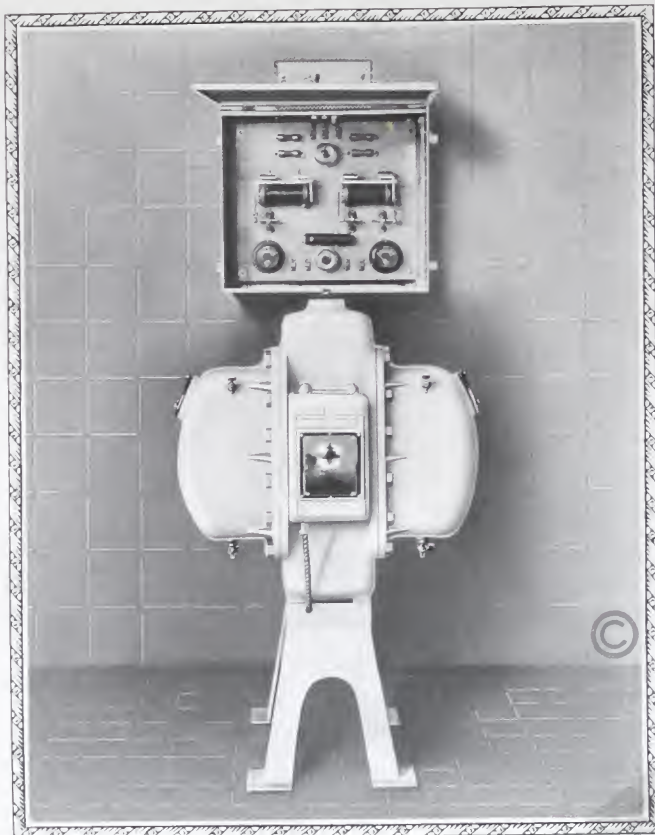


Type B-2 R. U. V. Sterilizer

There is furnished with the sterilizer a steel cabinet within which is fixed a marble control panel. Mounted upon this panel are the necessary fuses, current switches, ammeter and volt meter with multiplier. Mounted on top of the control cabinet are the ballast resistance coils necessary for proper operation of the lamp. Simple adjustments for proper current conditions are provided. These conditions, indicated by the ammeter and volt meter, are visible to the operator and always under his control. The lamp, therefore, may always operate at its maximum efficiency, which, in turn, ensures its maximum length of life.

The entire apparatus is extremely attractive in appearance and simple in operation.

Its capacity is 120 gallons per hour.



Type H-2 R. U. V. Sterilizer

sary either to disturb the lamp or remove the tube. Simply unbolt and remove the wings. A rag may then be readily passed around the tube to clean it.

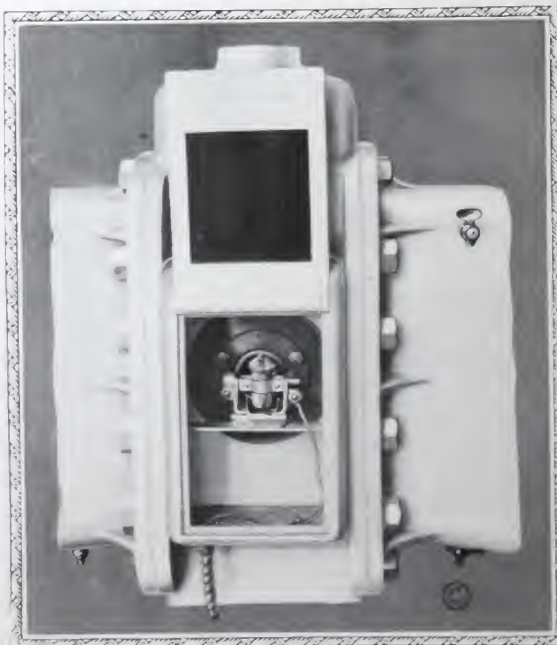
This main casting is provided with both front and rear lamp boxes with swinging doors. The bowl or negative end of lamp is held in a lamp holder supported by a bracket fixed in the front lamp box. The door of this lamp box is provided with a bull's eye so that the illumination from the lamp is always visible. The stem of the lamp extends through the quartz tube. Surrounding the bowl of the lamp is a cylindrical brass ventilating cap, adjustable for proper ventilation of the lamp. This cap is omitted in the accompanying cut in order to show the mechanism details. The metal or positive end of the lamp passes through a transite disc fixed within an adjustable brass ring, which is, in turn fastened in a vertical brass sliding plate. This plate is connected to the lamp starting handle by a vertical adjustable brass rod. The starting handle hangs outside the rear lamp box. The rest of the mechanism to which the handle is attached, is housed within the lamp box.

Type H-2 R. U. V. Sterilizer

This type operates under pressure. It may, therefore, be connected to the pressure service line or pump discharge line.

It consists of a three-part brass casting,—a main body casting with two wings bolted to each side of it. Assembled, it is shaped like a Maltese cross. It is supported on a cast-iron base. Through the center of the main casting is fixed a protecting quartz tube packed against external water pressure. Inside this tube the lamp is suspended.

Inside the casting, forming part of it, are six baffle plates around which, in its passage through the sterilizer, the water is forced to flow. The water enters at the bottom. The stream divides and passes around the baffles against the quartz tube in a thin film, to the outlet at the top. As in type B-2, all the water is continuously exposed to the rays, turned over and brought close to the lamp twice. The protecting quartz tube prevents the water coming in contact with the lamp. To clean the outside of the quartz tube it is unnecessary



Interior of Front or Negative Lamp Box.
Cylindrical Ventilating Cap Omitted

To start the lamp, turn on the current, lift the starting handle to its full height and immediately lower it. This lifts and lowers the sliding brass plate and transite disc through which the stem end of the lamp passes, as already described. This causes the mercury in the lamp to "bridge" and then "break" thus forming the mercury vapor arc as previously described. The lamp operates on 220 volts direct current at approximately 3.5 amperes. It consumes therefore, an electrical energy of .77 K. W. Detailed instructions for the operation and adjustment of the lamp for proper current and voltage are furnished with the apparatus.

There is furnished with the sterilizer a steel cabinet within which is fixed the marble control panel. Mounted upon this panel are the necessary fuses, switches, automatic series and shunt relays, ammeter and volt meter with multiplier. Mounted on top of the cabinet are the ballast resistance coils necessary to the proper operation of the lamp. Simple adjustments for proper current conditions are provided. These conditions, indicated by the ammeter and volt meter, are visible to the operator and always under his control. The lamp, therefore, may always operate at its maximum efficiency, which, in turn, insures its maximum length of life.

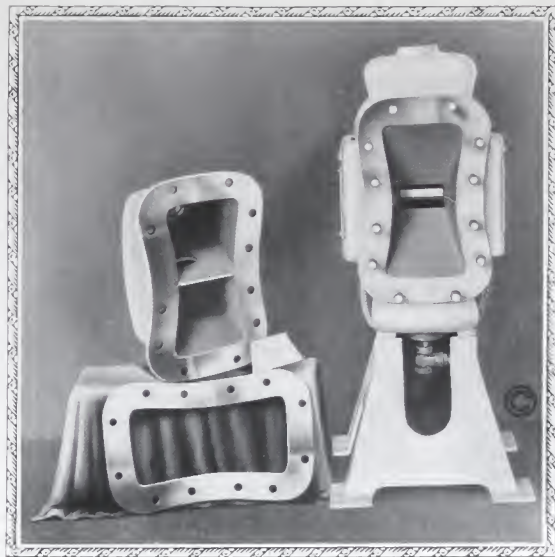
It will be noted that this control panel provides shunt and series relays not shown on the panel for type B-2. These relays are necessary owing to the higher voltage at which the lamp for type H-2 is operated. When the current is first turned on the electricity flows through all four of the ballast resistance coils. When the lamp in "building up" has attained a specified voltage, the shunt relay closes automatically, short-circuiting and thus cutting out two of the ballast resistance coils.

Glass inserts are provided in each of the two body wings, so that the illumination from the lamp is visible at the sides as well as at the lamp box bull's eye.

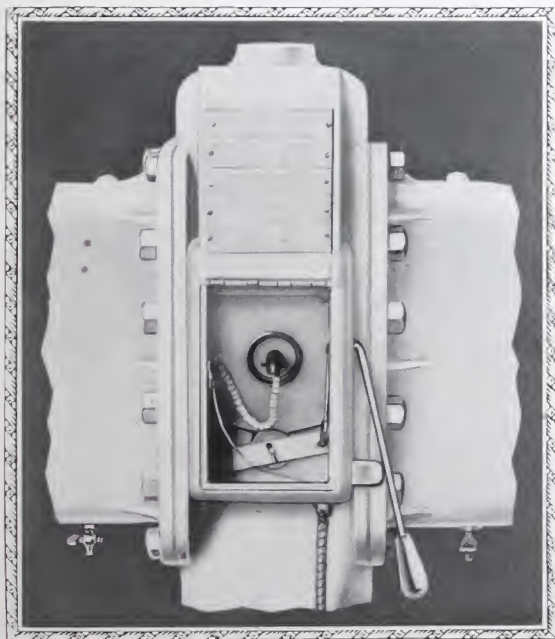
These inserts are of plain glass to allow full illumination from the lamp. They are set at such an elevation from the lamp, however, that the rays from the lamp are not directly visible, thus furnishing protection to the eyesight. If it is desired, the action of the lamp "building up" may, when a proper angle of vision is obtained, be observed through these inserts. In this event it is recommended that colored glasses, to protect the eyes, be used.

The sterilizer is 26" wide by 15" thick. Mounted on its base it is 41" high.

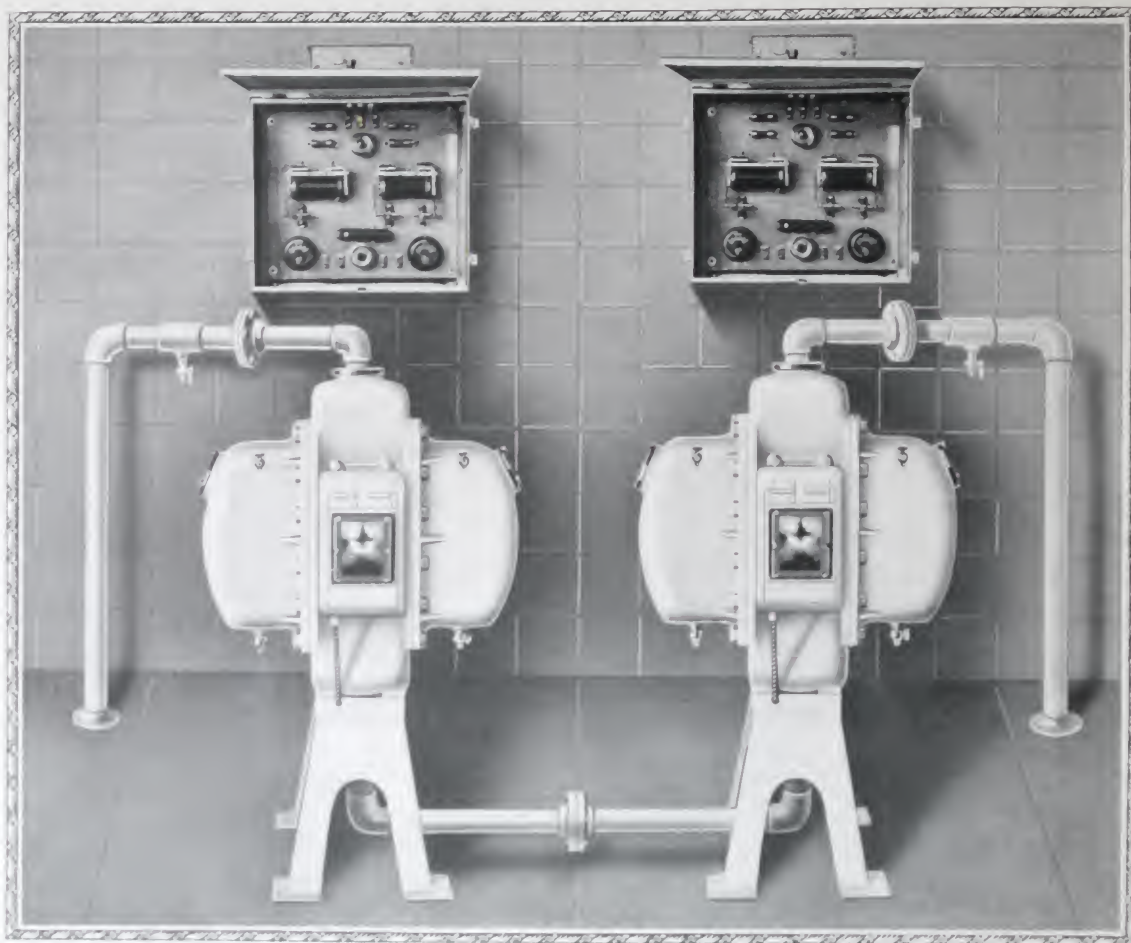
The capacity of type H-2 is 750 gallons per hour for direct flow, and 1,000 gallons per hour for circulating systems.



Type H-2 R. U. V. Sterilizer—Dismantled



Interior of Rear or Positive Lamp Box with Lamp Fitting Mechanism



Type H-22 R. U. V. Sterilizer

This type consists of two Type H-2 sterilizers connected together at the bottom openings. The water flows through them in series,—down through one, through the connecting pipe, and up through the other. The course of the water inside the sterilizers is the same as described in Type H-2, except that the flow in the first unit is reversed.

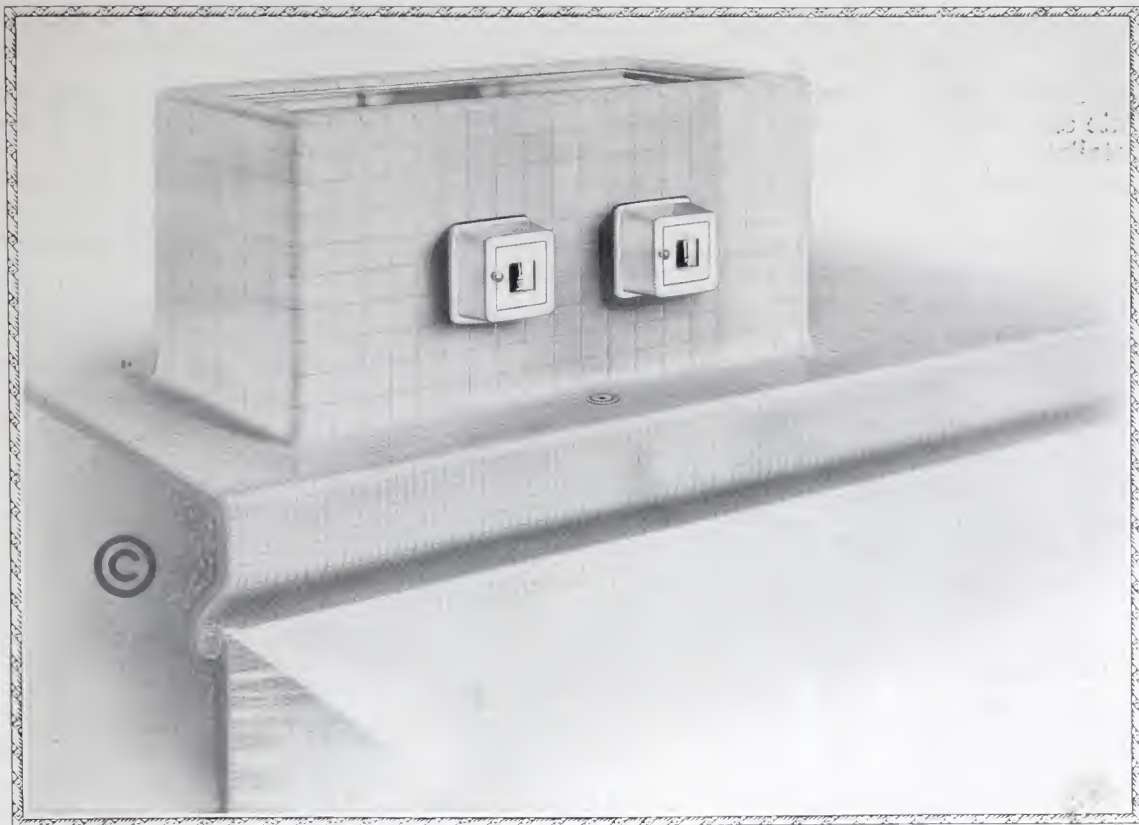
A control panel as described before for Type H-2 is furnished for each unit, thus insuring maximum efficiency and maximum life for each lamp.

As two 220-volt lamps are used the electrical energy consumed is twice that of Type H-2 or 1.54 K. W.

It will be noted that the water flows past the two lamps in series. Bacteria are thus subjected to two successive lamp actions. It is not necessary, therefore, as in Types B-2 and H-2 to rely upon one lamp alone for bacteriological extermination. The velocity of the water past the lamps may, therefore, in this type, be considerably increased and perfect sterilizing results still secured.

The capacity of Type H-22 is 3,000 gallons per hour for drinking water systems and 4,000 gallons per hour for swimming pool circulating system.

The floor space required is approximately 6'6" by 2'.



Type D-22 R. U. V. Sterilizer

This type operates by gravity and must, therefore, have a free or open discharge at its outlet. It may be lined on the outside with tile or glazed brick to harmonize with its surroundings. The inside is finished with a waterproof plaster coat—coated with marine enamel. The tank is equipped with two 220 mercury vapor lamps suspended inside quartz tubes. The lamp boxes, starting mechanisms and lamp ventilating devices are similar to those furnished with type H-22. Around the quartz tubes are baffles fixed in the tank which cause the water in its passage through it to flow around or near the lamps successively in a thin film. The water enters the bottom at one end of the tank and flows up over a weir, through the two baffle openings around the quartz tubes within which the lamps are suspended, thence over a final weir to the outlet at the other end of the tank.

Two control panels as described for type H-2—one for each lamp—are furnished.

The current consumed is 1.54 K. W., the same as in type H-22.

In this type there are two successive lamp contacts as in type H-22. In addition, bacteria are subjected to the combined illumination of both lamps. This feature allows a greater velocity of flow past the lamps and consequently greater capacity.

The outside dimensions of this type are 6'4" long by 2' wide by 2'11" high. The inside dimensions are 5'6" long by 1'2" wide by 2'5" high.

The capacity of this type is 5,000 gallons per hour.

R. U. V. Sterilizers Of Larger Capacities

In sterilizers of capacities of over 5,000 gallons per hour, type D-22 may be extended to any capacity desired by the simple process of extending the length of the concrete flume to accommodate the number of lamps necessary to the capacity desired. A control panel described in type H-2 is furnished for each lamp. We shall be glad to submit proposals for sterilizers of this type for any desired capacity.



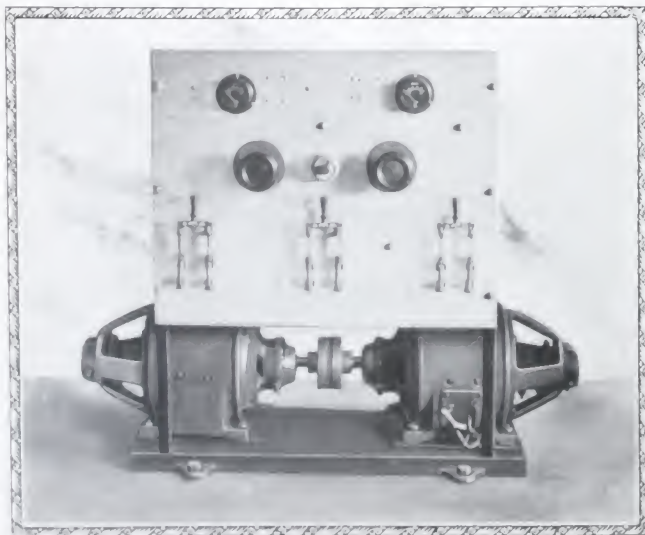
Automatic Water Controlling Devices

The government requirements for drinking water apparatus for installations on interstate carriers specify that all types of R. U. V. sterilizers be further safeguarded by the installation of automatic water controlling devices. These consist of a solenoid operated valve placed on the inlet pipe of the sterilizer and wired in connection with the lamp. Should the lamp go out through failure of voltage on the line, failure of the lamp itself, or for any other reason this solenoid loses its magnetism and the valve immediately shuts by gravity. No water can then pass through the sterilizer. When the lamp is again in operation, the solenoid regains its magnetism and the valve opens. Automatic controlling devices delay this action until the lamp has attained its maximum intensity. No water, therefore, can pass through the sterilizer unless the lamp is operating properly.

These government specifications together with further requirements specified to prevent the sterilizers operating at capacities beyond their normal ratings, were occasioned by isolated location of apparatus and engineering conditions peculiar to the installations involved. These automatic water controlling devices, therefore, are not included in our standard apparatus, but can be furnished at a nominal extra charge for drinking water service where similar engineering conditions render their installation advisable.

These devices are not required in government specifications for swimming pool installations.

Motor Generator Sets.



Motor Generator and Switchboard

It will be noted that the lamps used in all types of sterilizers operate only on direct current. Where alternating current only is available, motor generator sets, to transform it to the direct current required, must be installed. These sets consist of a motor of proper horsepower wound to conform to the available alternating current, and a generator of the capacity necessary to the type of sterilizer required. The motor and generator are mounted on a common cast-iron base and joined by a flexible leather link coupling. A marble panel switchboard bolted to angle irons attached to the base is also furnished. Upon this panel are mounted the field

rheostat, back of board starter, voltmeter, fuses and switches necessary to the proper operation of the motor generator set. We carry all necessary types and sizes in stock and will gladly quote prices upon request.

Filters.

It will be noted that for perfect sterilizing results, clear water is essential. If filters are necessary for clarification of the water to be sterilized we shall be glad to quote prices on any size required. All sizes are carried in stock.

Advantages Of Ultra Violet Ray Sterilization.

1. *Efficiency.*

Bacteriacidal action is positive, direct, and unavoidable.
The human element forms no part of the process.

This does not mean that the apparatus is entirely independent of the human factor. Any apparatus requires *some* attention. With Ultra Violet Ray Sterilizers the quartz tube must, from time to time, be cleaned. The lamp, like any other lamp, will eventually burn out and must be renewed. In these instances, the human element is necessarily involved. In so far, however, as the *process* is concerned—the passing of water around a mercury vapor lamp—the human element plays no part. Contrast this with chemical treatments in which the human element constitutes the greater part of the process.

2. *Results.*

We guarantee, when sterilizers are operated in accordance with instructions, complete removal of pathogenic or disease-producing bacteria—100% removal 100% of the time.

There is no change in taste, temperature, or appearance of the water treated.

There is no change in its chemical or mineral content. This is true of no other process of sterilization. With no other process may mineral waters be sterilized and still retain all their original properties.

3. *Scope.*

The process is applicable to all waters regardless of their temperature, chemical or mineral content. The only condition necessary for perfect results is that the water to be sterilized be clear.

The water must be clear because otherwise a bacterium gets behind or inside a particle of suspended matter and thus escapes the action of the rays. If, therefore, the water to be treated is not clear, it must be filtered. Any of the standard makes of filters will, under normal conditions, render any water sufficiently clear for perfect sterilization results.

4. *Simplicity.*

To operate all types, open a valve, turn a switch, and lift the starting handle. The apparatus does the rest.

5. *Space Occupied.*

Note the small floor space required in all types.

6. *Initial Cost.*

For like capacities, the initial cost, as compared with any other sterilizing apparatus is absurdly low.

With Ultra Violet Ray Sterilizers, the larger the capacity, the lower the relative initial cost. This is due to the fact that additional lamp units admit of astonishingly increased capacities. For instance, a two-lamp outfit gives four times the capacity; a three-lamp outfit gives ten times the capacity, and so on.

7. *Operating Cost.*

The small amount of current required makes the operating cost insignificant.

For example, a 110-volt lamp consumes an electrical energy of .385 K. W. The 220-volt lamp consumed .77 K. W. Assuming that the purchaser pays 2 cents per kilowatt hour for current it will cost approximately in current consumed three-quarters of a cent an hour to operate Type B-2; 1½ cents an hour to operate Type H-2; 3 cents an hour to operate types H-22 and D-22. To put it another way, a cost of current of 1 cent will produce 160 gallons with Type B-2; 500 gallons with Type H-2; 1,000 gallons with Type H-22 and 1,666 gallons with Type D-22.



"Lake Terrace," Residence of J. S. Newberry,
Grosse Pointe Farms, Michigan

drinking water supplies. Nevertheless there are still 300,000 cases of typhoid fever a year in this country, with 20,000 deaths resulting from them, all of which could be prevented by proper precautions as to water and food. At least 75 per cent—some authorities claim 90—are due to contaminated water.

Blind faith in the purity of any water, whether from springs, wells or surface supplies, is pernicious. Thousands of lives have paid the penalty for it. Textbooks are filled with records of water-borne disease epidemics. To subject those dependent upon us for their welfare to the possibility of water-borne infection is every bit as criminal as to poison their food. Sterilization of water alone precludes this possibility. No other method of water purification accomplishes complete removal of disease-producing bacteria. Other methods reduce. Sterilization eliminates. The moral obligation of water sterilization in the home,—the protection of those



"Fairholme," Residence of E. D. Speck,
Grosse Pointe Farms, Michigan



"Dry Brook," Residence of T. H. Newberry,
Grosse Pointe Farms, Michigan

Sterilization Of Drinking Water Supplies The Moral Obligation.

As suggested, although the widespread conviction of the necessity for it is of comparatively recent origin, the growth of water purification has been rapid. Many State Boards of Health are legally endowed with autocratic powers to compel water purification, and progressive Municipal Boards of Health, like that of Detroit, exercise wise control over local

dearest to us—is unanswerable. It applies equally to all classes of industry in which water for human consumption is furnished. It extends to all industries in which anything for human consumption is served in receptacles. Contraction of typhoid fever from milk supplies occurs only because milk has been stored in receptacles washed with contaminated water. In all these, carelessness, neglect, or indifference to the moral obligation is indefensible.

Sterilization of water is not a luxury. It is a duty.

Sound Business.

Entirely apart from the moral obligation, to provide pure drinking water reflects sound business judgment. Sickness is expensive and health is essential to efficiency. Any disruption to an organization, which may be caused by death, sickness, injury, or absence from work, means loss of production. Progressive corporations realize this, and maintain Bureaus of Safety to protect the health of their employees. Furthermore, they realize that a high standard in the shop raises the standard in the home.

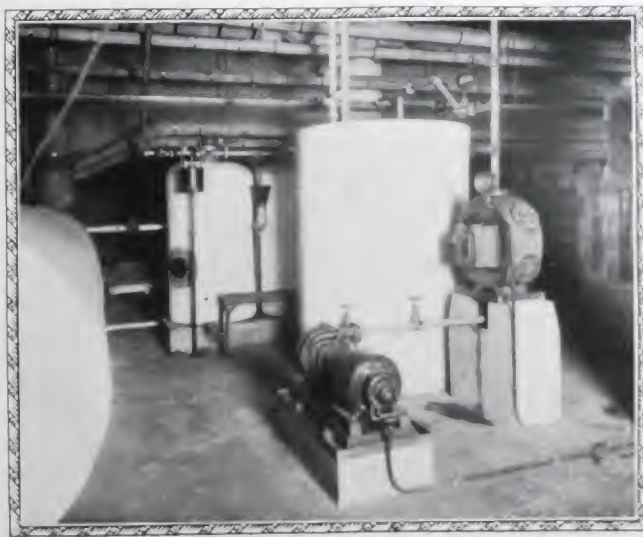
Water-borne disease, with its attendant loss of production, is an ever present danger. It may be entirely eliminated: and the reasonable investment required is more than justified by its returns. The cost of operation and maintenance of apparatus is so low that the loss occasioned by the sickness of even one man might far exceed it.

Marshall Field & Co., among the first to appreciate both the moral obligation and the business economy of pure water, were the earliest purchasers in Chicago of Ultra Violet Ray Sterilizers to provide sterilized drinking water for their many thousand employees.

The drinking water system at Sprague, Warner & Co., Chicago, has been called the "finest in the world." It consists of a standard refrigerating circulating system equipped with an Ultra Violet Ray Sterilizer connected into the circulating pipe line. The circulating pump, taking its suction from the cooling tank, pumps through the sterilizer to the distribution line. Upon this line, throughout the building, bubbling fountains are located. A float valve regulates the supply of make up water from the filters as water is consumed at the fountains. With each circulation the water passes through the sterilizer and is thus sterilized over and over again. Should any contamination, due to a defective fountain or any other cause, occur in the pipe line, the subsequent sterilization would eliminate it. Perfect protection against conceivable accident is thus provided. To protect employees is sound business. To protect those whose patronage is essential for industrial success is a business necessity. Hospitals, hotels, office buildings, steamboats, railroads, in fact, all industries dependent for success upon public patronage, require sterilized drinking water supplies. The loss of business resulting from the furnishing of impure water supplies would pay for sterilizers many times over. The cost of upkeep would be trifling in comparison with the loss of patronage.



Marshall Field & Co., Chicago



Sprague, Warner & Co., Chicago



Statler Hotel, Detroit, Mich.

Office buildings of the better class provide similar systems for their tenants. A single case of typhoid fever in any office building would mean unrented space. The nuisance of bottled water supplied from water coolers, the danger of contamination necessarily attendant upon its service, the questionable maintenance of the sanitary condition of water coolers, the continuous expense to the tenant of providing and maintaining such supplies—all these may be obviated. A circulating, refrigerating sterilization system, supplying cold sterilized water at each office tap or at sanitary drinking fountains, insures the highest possible degree of sanitation for tenants with a minimum of expense. The David Whitney Building at Detroit is equipped with this system. The successful operation of four years has justified its installation.

In both these classes of industry the moral obligation to provide pure drinking water for the protection of the health of patrons is undeniable. Entirely apart from this however, sound business policy demands it.

This applies directly to hotels, where purity of drinking water is peculiarly essential to patronage. Hotel managers realize that commercial travelers especially arrange their trips so that their longer periods of stop-over may be made where the sanitary conditions are the safest. In these conditions, the purity of the drinking water supply is particularly important. Sickness caused by water-borne infection would be attended with disastrous results, not only as to the health but also as to the resultant loss of business of the patron.

The Statler Hotel at Detroit is one of the many progressive organizations which provide sterilized drinking water for its patrons. A circulating refrigerating system, like that at Sprague Warner & Co., already described, provides cold sterilized drinking water at special taps in each room. Perfect protection to patrons is thus provided and bell-boy service of drinking water is dispensed with. A bell boy and an ice water bucket are not the highest ideal in sanitation attainment.



David Whitney Building, Detroit, Mich.

In all industries, where water itself is the product or where it forms part of it, sterilization of the water supply to insure purity of the product, should be made compulsory. Whether the water is drawn from springs, wells, or surface supplies, contamination at the source is a constant menace. The sudden unaccountable contamination of water drawn from underground sources due undoubtedly to subterranean fissures and consequent seepage, has occurred too often to require proof. Whatever the cause, it is certainly beyond the control

of human agency. Should contamination occur, the industry's greatest asset,—the market for its product—is irretrievably lost. Sterilization of the water supply before bottling provides perfect protection. It is business life insurance, the premium for which is an insignificant amount. The cost of upkeep of Ultra Violet Ray Sterilizers is trivial: the protection they furnish is measured only by what the industry is worth. An industry which may be worth millions of dollars to-day might be worth only scrap to-morrow. The time to safeguard the investment is now, before such contamination has occurred; that is when the far-sighted, prudent business man does it. To-morrow may be too late.

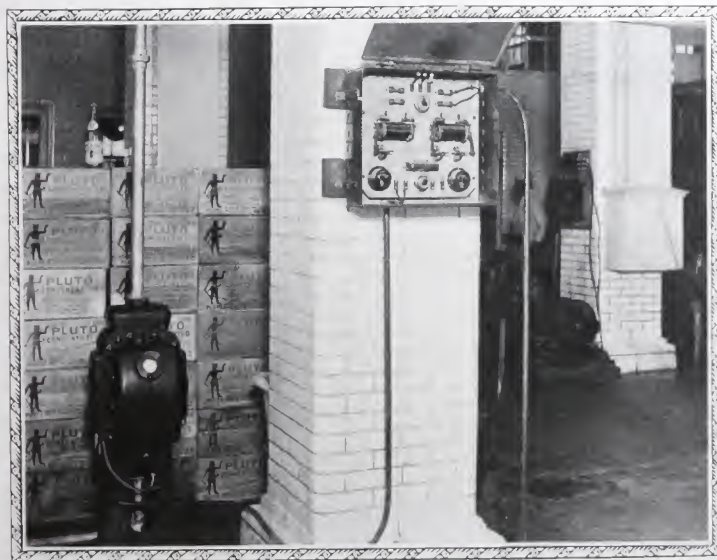
All Pluto water is sterilized immediately before bottling. This water, as drawn from the springs, is shown by analysis to be uniformly free from contamination and of a high degree of purity. It does not, under present conditions, require sterilization. Nevertheless, these springs *might* become contaminated at any moment. Irreparable damage would result. Pluto, in astonishing quantities, is shipped all over the world. The sound business judgment, which has developed its sale into a business which to-day is worth several million dollars, protects its market and its investment by sterilization.

The process is peculiarly attractive to bottlers of mineral water. Ultra Violet Ray Sterilization is the only known method which does not change the chemical or mineral properties of the water treated.

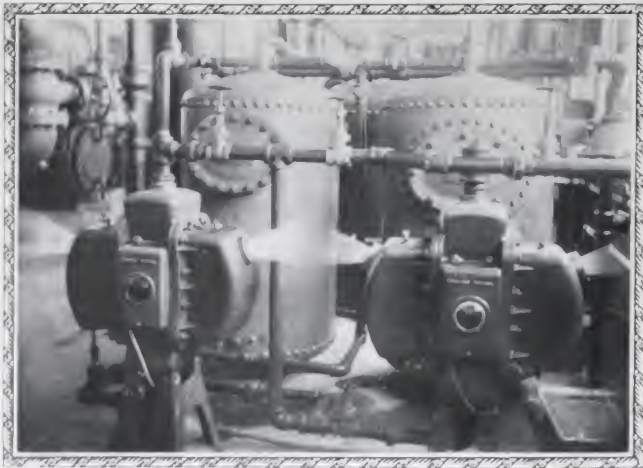
Contamination of bottles would be also disastrous. A water is no better than the vessel that contains it. Many a bottler washes bottles in a soaker and rinses them afterwards with tap water. If the tap water becomes contaminated, so will the bottles, and so, again, will the product. A bottler may safeguard this danger by rinsing bottles with sterilized water. He can afford to. It costs almost nothing to produce it.



"Pluto" Bottling Plant, French Lick Springs, Ind.



One of the two R. U. V. Sterilizers Sterilizing "Pluto" Water



Detroit Shipbuilding Co., Wyandotte, Mich.

The Direct Financial Liability

A large corporation, located in the Middle West (not the Detroit Shipbuilding Co.), has recently paid, without contest, over \$60,000 in settlement of suits for damages filed on account of sickness and death of employes resulting from contaminated drinking water furnished at its factory. Defective piping permitted polluted water from an adjacent river to seep into the artesian well from which the drinking water supply was taken. In this way, an unavoidable accident permitted the contamination of a supply which analyses had shown to be pure. Such accidents are al-

ways possible. The legal status of such a situation should not detract from the admirable spirit in which this corporation met the issue. It demands, however, serious consideration. If such financial liability exists, the employer of labor, whether or not he admits the moral obligation or the business economy of pure water, must furnish it to employes or pay the penalty for failure to do so.

In 1915 the Supreme Court of Wisconsin rendered a decision that the furnishing of a contaminated drinking water supply was an "accident" within the meaning of the Workmen's Compensation Act, and damages for death resulting from typhoid fever, contracted from the drinking water supplied by the New Dells Lumber Co., were awarded the plaintiff.

To make this ruling of the court clear in its scope, the Workmen's Compensation Act is briefly defined below. While this Act differs in details in different states, its general provisions are common to all. It provides that any workman who, during the hours of employment suffers injury from accident due to conditions existing through carelessness, indifference, or neglect of his employer, is entitled to financial compensation. In case of death his family may recover damages. If an elevator falls through overloading, if a defective boiler explodes, if oil dripping from machinery makes a floor slippery, if a work-out machine falls, and any injuries from such "accidents" to employes result, the employer is financially liable for the loss incurred. The employe does not have to prove that these conditions existed with the knowledge of the employer. The fact that they did exist is sufficient cause for damages. Fixed amounts are defined in the Act to cover specific injuries.

The Wisconsin decision, therefore, imposes upon every employer of labor a direct financial liability with which prudence must reckon. The case cited above gives some indication of the amount to which this liability may extend.

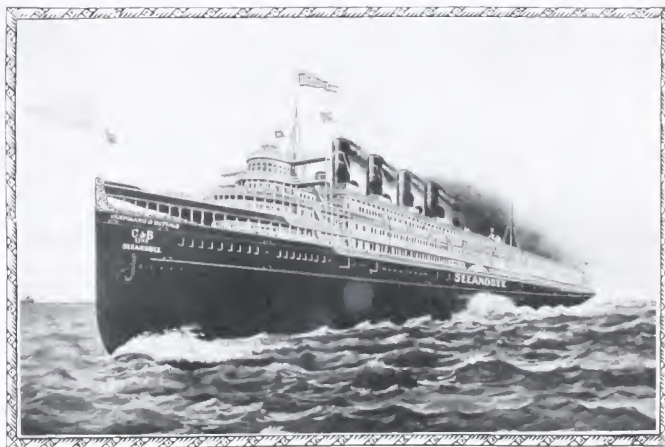
The installation of individual drinking water systems is the only sure, safe protection against this liability. Reliance upon outside agencies for the purity of drinking water supplies constitutes a potential danger. To say the least, such purity is not within one's own control. To eliminate this danger with its consequent financial liability, one must control his own water supply. Sterilization of it is the only sure protection.

We are often asked as to whether, if suit were brought for damages occasioned by contaminated water, the mere fact that Ultra Violet Ray Sterilizers were purifying the supply would constitute sufficient evidence to dismiss the suit.

The United States Public Health Service, in Public Health Report cited on page 1, is authority for the statement that Ultra Violet Ray Sterilizers, installed in accordance with its specifications, "cannot, under any conceivable circumstance, deliver a water that does not conform to Government requirements." This is an unusually sweeping statement and we voluntarily offer the amendment that the apparatus must be operated in accordance with instructions furnished by us. That these instructions had been unremittably followed might be difficult for the defendant to prove. It is fair to assume, however, that the burden of proof would rest upon the plaintiff. The fact that the apparatus had been installed, and that it did conform to the Government specifications above cited, would certainly show the court that the defendant had done everything humanly possible to safeguard its employes against "accident" which might be caused by the furnishing of contaminated drinking water. For these reasons, the installation of Ultra Violet Ray apparatus is the best insurance obtainable against claims of this character, but no positive guarantee can be given that its installation would, in every case, make a favorable verdict certain.

Liability under the Workmen's Compensation Act is by no means the only legal financial liability imposed upon the furnishing of contaminated drinking water. Four years ago, typhoid fever resulted from contaminated drinking water furnished by a well-known passenger steamer operating on the Great Lakes. (This was not the "See and Bee.") Suits for damages followed. A recent court decision fixed the damages at over \$50,000.

Steamers operating on the Great Lakes are engaged in interstate commerce and are, therefore, subject to Federal jurisdiction. The outbreak of typhoid fever just cited was directly responsible for the present government standard of drinking water supplies and the Government regulations relating to such supplies on interstate carriers. It led to the investigations of the United States Public Health Service referred to on page 1 which, in turn, led to the present Government specifications on water purifying apparatus.



The Great Ship "See and Bee"
Largest Side Wheel Passenger Steamer in the World.
Equipped with Ultra Violet Ray Sterilizers Installed Under
Government Specifications.

To-day practically every passenger steamer on the Great Lakes is equipped with Ultra Violet Ray Sterilizers, installed under specifications of the United States Public Health Service. Had they been so equipped four years ago, typhoid fever, with its resultant penalty, would not have happened.

These Government requirements referring to interstate carriers apply equally to railroads. Compliance with them is equally compulsory and will, without doubt, be equally insisted upon. The same liability for furnishing contaminated water exists and an equally severe penalty would doubtless follow.

This same liability applies to any industry supplying drinking water to patrons. In time State regulations will follow Federal regulations. Meanwhile the liability exists and the penalty would be equally severe.

The time to eliminate this liability is before the disaster happens. If it does happen, the damages fixed, as evidenced by the cases cited, are severe. The cost of insurance against this liability is, in comparison, trivial. Ultra Violet Ray Sterilizers are reasonable in cost. Their cost of upkeep is nominal.



Y. M. C. A. Building, Cincinnati, Ohio

Sterilization Of Water For Swimming Pools.

All authorities agree that the ideal swimming pool is one located in a swiftly flowing stream of absolutely pure water. The contamination communicated to the pool by bathers is thus carried down stream and disposed of. To reproduce this ideal condition in the indoor pool is obviously impracticable. The cost of operation involved in the continuous waste of water and heat is prohibitive.

Among the standards for swimming pool construction and maintenance adopted by the American Association for Promoting Hygiene and Public Baths is the following:

"Unless there is a constantly inflowing stream of absolutely pure, flowing stream of absolutely pure, filtration and disinfection."

clear, colorless fresh water, this condition should be approximated by filtration, re-filtration and disinfection."

To meet this standard a circulating pump, taking its suction from the deep end of the pool, pumps continuously through a filter and Ultra Violet Ray Sterilizer and discharges into the shallow end of the pool. The same water is thus used over and over again, re-filtered and re-sterilized with each circulation. The ideal condition is thus closely approached. There is a "constantly inflowing stream of absolutely pure water" and the bather contamination is disposed of,—not by waste, but by sterilization. There is no appreciable loss of water or heat during circulation. The prohibitive cost which would be occasioned by waste of water and heat is thus overcome.

Naturally the rate of circulation required to keep the pool in a sanitary condition is largely determined by the number of bathers using it and the consequent amount of contamination thus communicated to it. The more rapid the rate of circulation, the quicker the contamination is disposed of. Generally speaking, experience has shown that a complete turn over of the pool once in twenty-four hours will, with continuous operation for the whole period, keep the pool in a sanitary condition.

The old method of operating pools consisted in completely emptying and refilling the pool at periodic intervals "as occasion required." In the absence of analyses showing when the "occasion required," the operator emptied the pool when it "looked dirty." Unfortunately, the physical appearance of water is no criterion of its purity. Any pool will become grossly polluted long before it "looks dirty." To keep a pool operated in this manner in a sanitary condition requires in most instances emptying and refilling every day. The cost of water and heat is, under these circumstances, so excessive, that the sanitary condition is often sacrificed on the altar of finance.



Great Lakes Naval Training Station
One of Eight Pools equipped under Government Specifications

The saving in water and heat effected by a circulating and sterilizing system as against this old method will, within a comparatively short time, pay for the cost of installation of apparatus required. A case in point is that of the Hamilton Club at Chicago. Two years ago this pool was operated by the old method. It was emptied and refilled 121 times a year. Even so "an analysis of the water showed an enormous quantity of bacteria growing at body temperature."

(Report of U. S. Public Health Service, Hamiltonian, August, 1917, issue.) A circulating system with Ultra Violet Ray Sterilizers was installed two years ago. The net savings in water and heat since

then *have more than paid for the cost of installation* of the complete apparatus required. Not only this, but repeated analyses during this time have shown the pool to be in an unexcelled sanitary condition. The water is uniformly free from intestinal bacteria.

Every pool operator should *know the condition* of his pool and not guess at it. To assume its condition from its appearance is pernicious. Ignorance and neglect of sanitary conditions or indifference to them are inexcusable. In time, every pool will be under

the jurisdiction and supervision of Boards of Health, not only as to construction and equipment but also as to operation. All swimming pool operators will be compelled to maintain the highest possible sanitary conditions or to cease operation. No other course should be permissible. Meanwhile action must be voluntary and infection must pay the cost of neglect. Progressive organizations realize the dangers of swimming pool infection and do not require compulsion in safeguarding the health of their members.

Filters alone in connection with circulating systems cannot be expected to furnish the degree of purification required to maintain a high standard of sanitary condition. In many pools chemical disinfection is employed. The human element involved in its application, however, forms too great a factor. If too little chemical is added, the disinfection is inadequate. If too much, an overdose results, with serious effects on the eyes, noses, and throats of bathers. In Ultra Violet Ray Sterilization, while proper care of the apparatus is, of course, necessary, the human element forms no part of the process. Results are positive. An "overdose" is impossible.



Swimming Pool, Hamilton Club, Chicago



Milwaukee Athletic Club

The Bulletin of the Detroit Board of Health, August, 1917, gives the results of one year's analyses on all Detroit pools. Some pools showed bacterial counts of over half a million bacteria per cubic centimeter. (The Government standard of drinking water allows 100.) The Report says: "Pool No. 2" (the Detroit Y. M. C. A.) "has no close competitor either in total bacteria or in the colon group. We may safely attribute this purification to the use of the *Ultra Violet Ray* on all recirculated water. It should be stated here that all the other pools were using some form of chemical sterilization, either calcium hypochlorite or copper sulphate, but the method of adding depended on the human agency—there was nothing methodical or regular in its use."



Detroit Athletic Club

The pool at the Detroit Athletic Club, referred to as Pool No. 1 in this Bulletin, showed, for the year, an average count of 26,700 bacteria per cubic centimeter, with a maximum of 216,000. All samples showed *B. Coli.* (intestinal bacteria). This pool was already equipped with a circulating and re filtering system and chemical disinfection was used. The pool was emptied and refilled once a week. Upon publication of the Board of Health Bulletin, Ultra Violet Ray Sterilizers were installed and chemical disinfection abandoned. No other change in operation was made. The official test following this installation showed a maximum count of 85 bacteria per c. c. in the pool (lower than that allowed in the Government standard of drinking water). All samples, including those taken from the pool itself, showed entire absence of intestinal bacteria. Certainly these analyses show a striking contrast with previous conditions.

The highest possible sanitary condition of swimming pools is secured with Ultra Violet Ray Sterilizers. Where vacuum cleaning devices are used swimming pools equipped with circulating systems and sterilizers may be operated practically indefinitely without emptying and refilling, with no deterioration of sanitary conditions.



Swimming Pool, Union League Club, Chicago

The pool at the Union League Club, Chicago, was not emptied and refilled during the entire year of 1917. Frequent analyses to determine its sanitary condition were made. In commenting on its condition at the end of that time, the report of the University of Chicago said: "You are to be congratulated on the excellent condition of your water in the pool. It would pass the standard set for drinking water for interstate carriers. I hardly thought such a thing possible in swimming pools."

Similar records of many other pools are available. Some of these pools are used by over 800 bathers a day.

Naturally these long periods of operation between emptyings reflect very substantial savings in the expense of water and heat otherwise occasioned. These are mentioned, however, only as an attendant circumstance. Above all other considerations, the highest possible sanitary condition of a swimming pool should be its operator's constant aim. Swimming pool waters should be judged by the drinking water standard. They are unavoidably taken into the system by bathers and contamination of them will cause infection. If a water is not fit to drink it is not fit to swim in. This is a self-evident fact regarding which there can be no contention. Keep a pool in a sanitary condition or close it. Eventually this will be compulsory.

Ultra Violet Ray Sterilizers will maintain the highest possible sanitary standard and by this standard they should be judged. If, in addition, they reduce operating expenses—and there is abundant evidence to prove it—so much the better.

Either Type H-22 or Type D-22 are used for swimming pools. The capacities, as



St. Paul Athletic Club



Minneapolis Athletic Club

stated previously, are 4,000 and 5,000 gallons per hour respectively. With Type D-22 very artistic effects may be obtained by taking full advantage of the illuminating effect of the rays. The Minneapolis Athletic Club installation, cut of which is shown, is particularly effective in its artistic arrangement. The apparent panel of Ultra Violet Ray illumination immediately above the sterilizer was produced by setting the sterilizer back into a recess built in the wall and curving the back wall of this recess up and over the sterilizer.

We have had many years' experience in designing swimming pool apparatus with special view to the proper heating, filtration and circulation of the water. Our engineering department will be glad to offer suggestions or make plans for individual problems brought to our attention. Correspondence is invited.



Chicago Athletic Association

Information Required To Estimate Proposed Work

In writing, give us, in all cases, characteristics of electric current used. If it is direct current, give us voltage. If alternating, give us voltage, phase and cycle.

Regarding drinking water installations, give us all the information you can as to your present service. If the supply is direct from the mains, what is the estimated maximum consumption in gallons per minute? If it is from an elevated tank by gravity, how is the tank filled and at what rate, in gallons per minute? If a circulating system is used, what is the rate of circulation, in gallons per minute? Is the water clear? If not, are filters used? If so, what is their type and diameter? All such information will aid us in recommending the type of sterilizer best suited to our requirements.

Regarding swimming pool installations, give us the size of your pool and the present method of operation. If it is merely emptied and refilled, are filters used? If so, what is their type and diameter? Is there any other equipment that could be used for a circulating system? If a circulating system is already used, what is the rate of circulation or the diameter of the filters? Are vacuum cleaning devices used? Give us all the information you can regarding your present mechanical equipment, the room available for installation of additional apparatus, the width of widest openings to point of installation, etc. A sketch showing complete layout is especially desirable, particularly in regard to piping if no circulating system is already installed.

In order to enable us to estimate operating expenses, kindly tell us what rate you pay for current (Ultra Violet Ray Sterilizers come under power rates). Also tell us how often the pool is at present emptied and refilled and the cost of water and heat per fill. If you have no record of this, give us the rate paid for water, the kind of coal used, and its cost per ton.

We give below some typical R. U. V. installations located within the territory controlled by us.

Drinking Water Supplies

(Interstate Carrier Installations made under Government Specifications)

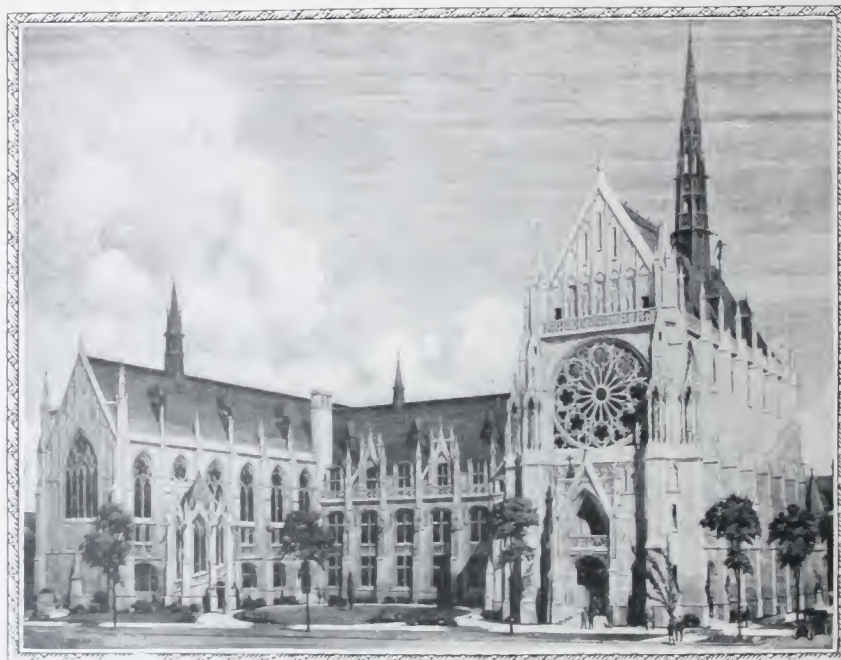
Detroit & Cleveland Navigation Co., Steamers.....	Detroit, Mich.
Cleveland & Buffalo Transit Co., Steamers.....	Cleveland, Ohio.
Goodrich Transit Co., Steamers.....	Chicago, Ill.
Chicago, Duluth & Georgian Bay Transit Co., Steamers.....	Chicago, Ill.
Graham & Morton Transportation Co., Steamers.....	Benton Harbor, Mich.
Great Lakes Transit Corporation, Steamers.....	Buffalo, N. Y.
Chicago & South Haven Steamship Co., Steamer "Petoskey".....	Chicago, Ill.
Calcite Transportation Co., Steamer "Calcite".....	Detroit, Mich.
Crosby Transportation Co., Steamer "Holland".....	Milwaukee, Wis.
Mackinac Transportation Co., Steamer "Chief Wawatau".....	Marquette, Mich.
Marshall Field & Co., (Wholesale).....	Chicago, Ill.
Sprague Warner & Co.....	Chicago, Ill.
Detroit Shipbuilding Co.....	Wyandotte, Mich.
Burroughs Adding Machine Co.....	Detroit, Mich.
American Steel & Wire Co.....	Joliet, Ill.
American Steel & Wire Co.....	Cleveland, Ohio.
Diamond Match Co.....	Barberton, Ohio.
Wisconsin Telephone Co.....	Milwaukee, Wis.
Milwaukee Athletic Club.....	Milwaukee, Wis.
The Palmolive Co.....	Milwaukee, Wis.
Universal Portland Cement Co.....	New Duluth, Minn.
Proctor & Gamble Co.....	Ivorydale, Ohio.
Timken Detroit Axle Co.....	Detroit, Mich.
Lincoln Motor Co.....	Detroit, Mich.
French Lick Springs Hotel Co. ("Pluto").....	French Lick, Ind.
Milwaukee-Waukesha Brewing Co. ("Fox Head" Water).....	Waukesha, Wis.
Statler Hotel.....	Detroit, Mich.
Fort Des Moines Hotel.....	Des Moines, Iowa.
Detroit News.....	Detroit, Mich.
Cleveland Heights School.....	Cleveland Heights, Ohio.
Wayne County Home & Savings Bank Bldg.....	Detroit, Mich.
David Whitney Building.....	Detroit, Mich.

Swimming Pool Installations

Great Lakes Naval Training Station.....	Great Lakes, Ill.
(Eight pools equipped under Government specifications)	
War Department, Scott Aviation Field.....	Belleville, Ill.
Chicago Athletic Association.....	Chicago, Ill.
Minneapolis Athletic Club.....	Minneapolis, Minn.
St. Paul Athletic Club.....	St. Paul, Minn.
Milwaukee Athletic Club, Men's Pool.....	Milwaukee, Wis.
Milwaukee Athletic Club, Women's Pool.....	Milwaukee, Wis.
Detroit Athletic Club.....	Detroit, Mich.
Union League Club.....	Chicago, Ill.
Hamilton Club.....	Chicago, Ill.
University of Chicago, Ida Noyes Hall.....	Chicago, Ill.
University of Illinois, Men's Gymnasium.....	Urbana, Ill.
Quigley Preparatory Seminary, Archdiocese of Chicago.....	Chicago, Ill.
Culver Military Academy.....	Culver, Ind.
Gilbert Manual Training School.....	Gilbert, Minn.
Virginia Technical High School.....	Virginia, Minn.
Chisholm High School.....	Chisholm, Minn.
Eveleth High School.....	Eveleth, Minn.
St. Cloud High School.....	St. Cloud, Minn.
East End High School.....	Akron, Ohio.
Young Women's Christian Association.....	Youngstown, Ohio.
Young Men's Christian Association.....	Cincinnati, Ohio.
Young Men's Christian Association.....	Dayton, Ohio.
Young Men's Christian Association.....	Detroit, Mich.
Firestone Tire & Rubber Co.....	Akron, Ohio.
Fenwick Club.....	Cincinnati, Ohio.
Municipal 5th Ave. Natatorium.....	Milwaukee, Wis.



High School, Chisholm, Minn.



Quigley Preparatory Seminary, Chicago, Ill.



Ida Noyes Hall, University of Chicago





WATER STERILIZATION



JAMES B. GLOW & SONS
CHICAGO